

# Analysis and Design Optimize Data for the Depok Center Information System's Health Services on the E- Government Data Warehouse Application using an Olap Pivot Table and Star Schema

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**Abstract**— Interoperability is a hot topic for institutions and researchers worldwide thanks to the advent of new technology, equipment, and communication Suggestions. The amount of data integrated is now increasing year by year, month by day even. So, traditional algorithms and technologies are now inefficient in processing, analyzing, and storing vast amounts of data. Increased use of data integration leads to more efficient technologies urgently needed to divide data and process data between data sources. Interoperation of information system applications into the urgent requirement for e-gov development in Indonesia today. The ultimate goal to achieve through the interoperable solution between the e-gov applications is the creation of an integrated and communicable information system. In the study, data management warehouse could drive the quality of monitoring of leaders faster and more optimally. So it can be used as information and strategic services that make it easier for the public to access information and services provided by the city's depok government. And for monitoring the activity of each device area can also be monitored by leaders to assist performance assessments of each center as a generated data contributor to and performance so that data accuracy and performance on the application increases.

**Keywords**— Interoperability, DW, centralized data.

## I. INTRODUCTION

The development of e-Government is an effort to develop governance both internally and public services based on Information and Communication Technology (ICT) in order to improve quality, effectiveness, and efficiency.

Organizing and managing good data will produce a lot of information needed in the management system. Information supported by technology will also be easily developed into statistical information and new products.

This condition requires the collection of a lot of data with good quality, so that its use can be optimally useful. This archiving system and historical data analysis with a certain schedule is called a Data Warehouse. The Depok City Data Warehouse has been completed until 2018 with the data that has been built including:

- 1) INCOME: PBB, BPHTB, Hotel & Restaurant Tax (SISMIOP, SIMPAD)
- 2) LICENSING: Permits issued (IMB, SIUP, TDP, IPREK, IMTA, IUJK, IUPAR, ITPSLB3, IUPP, IUTM, SIK, IPR, PC, Puskesmas, TDG)
- 3) HEALTH: Patients, Health Centers, Diseases

- 4) EMPLOYMENT: Employee data, number of employees per year, number of employees per Regional Apparatus, employee groups based on age group, gender, distribution of employee salaries per Regional Apparatus
- 5) FINANCE: Budget Realization Report (Description, Budget, Budget Realization, Percentage of Realization)
- 6) EDUCATION: Data on teachers, students, number of schools, number of teachers, number of good and damaged school facilities, number of students in each sub-district, outputs. Number of teacher students per school.
- 7) DEVELOPMENT : Monitoring Report on Activity Performance Achievement (Name of Activity, Target, Realization, Physical)

However, along with the development of the system or application, the data generated in terms of the sector becomes more and more. Existing problems:

- a. Not all of the data generated by the system or application in each Regional Apparatus is integrated with the Data Warehouse;
- b. Data Warehouse development stages that follow the growth of existing systems or applications in each Regional Device

With the completion of the Data Warehouse development activities and continued with the development of the Data Warehouse in Depok City, it is hoped that the data from each system and application in the Regional Apparatus can be accommodated properly. So that it can be used optimally as executive strategic information for policy and decision making.

The Depok City Communication and Informatics Service as the leading sector of e-Government development in the Depok City Government, seeks to realize the data integration system by developing a Data Warehouse on a regular basis in accordance with the growth of the existing system or application in each Depok City Regional Apparatus.

## II. THEORITICAL BASIC

### A. Related Research Journals

In the research of Krisanda, Arwani, and Eka (2017), developing a Data Warehouse and Online Analytical Processing (OLAP) for Article Data Analysis in the Journal of Information Technology and Computer Science (JTIK),

which aims to analyze the development of the number of authors each year, and the distribution author. In this study, using the Snowflake Schema which is a method of normalizing the dimension table on the star schema. The results of the dimension table normalization method make the structure in the snowflake schema resemble a snowflake with a fact table in the middle. There are 2 dimensional data modeling of Snowflake Schema, namely Article Data Snowflake Schema and Writer Data Snowflake Schema, which then analyze using OLAP and generate reports and graphs for each data.

Then in the research of Septianfan, Willyanto, and Puspa (2019) to design and create a Data warehouse and Business Intelligence at the Honda MPM Motorcycle Market Research which aims to analyze the new market by implementing a data warehouse and also a report application. This research also uses the Snowflake Schema method which is implemented through OLAP tools. The Snowflake Schema that has been designed has fulfilled its function as a data repository that allows market analysis data report makers to retrieve data to a single place that can access sales and government data at the same time. The resulting reporting application helps make it easier to provide the information needed by the division head. In this study also distributed questionnaires related to reporting applications with display design indicators, facilities provided, then in running the application, ease of reading information, convenience provided by the application, and overall assessment.

The next research from Wildan, Abims, Yuda, and Hardianto (2021), which implemented the Star Schema in a university-scale library case study that aims to solve problems related to data integration using a nine-step methodology, which includes process selection, grain selection, dimension identification, fact selection, fact storage, ascertaining dimension table, selecting database duration, tracking dimension change, prioritization and query model. After carrying out the ETL process and data validation, the results of the study show that the implementation of the nine-step methodology can help the data warehouse work to be more structured, organized and well-documented. The data warehouse has been successfully created using the Star Schema. The data warehouse and OLAP support for making the decision to add books have been successfully created using the PDI Kettle for the integration process and resulted in 3 dimensions from the 4 grains found. And the validation test gives the result that the data on all fact tables, circulation, and members are valid.

### B. *Electronic-Based Government System (SPBE)*

Based on Presidential Regulation Number 95 of 2018 concerning Electronic-Based Government Systems, Electronic-Based Government Systems, hereinafter abbreviated as SPBE, are government administrations that utilize information and communication technology to provide services to SPBE users. The definition of the use of SPBE itself in Presidential Regulation Number 95 of 2018 is the central agency, regional government, employees of the State Civil Apparatus, individuals, community business actors, and

other parties who utilize SPBE services.

Furthermore, in the Presidential Appendix Number 95 of 2018 concerning the Electronic-Based Government System, it is explained about SPBE or e-government, namely government administration that utilizes ICT to provide services to government agencies, state civil servants, business people, the community and other parties.

Presidential Attachment Number 95 of 2018 concerning Electronic-Based Government Systems states that SPBE's vision is "The realization of an integrated and comprehensive electronic-based government system to achieve high-performing bureaucracy and public services". This vision becomes a reference in realizing the integrated implementation of SPBE in Central Agencies and Local Governments to produce an integrative, dynamic, transparent, and innovative government bureaucracy, as well as improving the quality of public services that are integrated, effective, responsive, and adaptive.

### C. *E-Government*

E-Government is the use of information technology by the government to provide information and services to the public, as well as other matters relating to government. For this reason, there must be innovation in the implementation of public services so that the process of providing public services in question becomes more efficient, effective, transparent, and accountable.

E-Government is intended for: (a) governments that use technology, especially web-based internet applications to improve access and delivery of government services to the public, business partners, employees, and other governments; (b) a process of reform in the way government works, share information and provide services to internal and external clients for the benefit of both government, society and business; and (c) the use of information technology such as wide area network (WAN), internet, world wide web, computers by government agencies to reach the public, business and other branches of government to improve services to the community, improve services to the business world and industry, empowering the community through access to knowledge and information, and making the government work more efficiently and effectively (Habibullah: 2010).

### D. *Data Warehouse Concept*

Data Warehouse is a collection of data that has the nature of subject oriented, integrated, non volatile and time variant which is to support the management decision-making process. Basically the Data Warehouse is built with a Multidimensional model, which can view data from every dimension angle or commonly called a dimension, which is usually called a Cube or Hypercube.

Cube itself contains dimensions and facts or commonly called fact. Cube is an example of a Sales Cube, where there is a dimension which means the point of view used to analyze data. In the Cube image there are three dimensions, namely Time, Customer and Product. Each dimension shows the details, stages and details where Measures shows the value for

each dimension, whether the value is SUM or COUNT.

Hirarches is a sequence of relations between levels in the dimension from the lowest to the highest level. There are 2 level relations in Hierarchies. The lower level is the child, while the upper level is the parent.

Each measure in a cube corresponds to an aggregation function which is combined with multiple measures into a value. Aggregation of a measure occurs when a change occurs in the data contained in a cube. This is done by traversing the hierarchies of dimension

**E. Data Warehouse Architecture**

ETL or Extract Transform Load is a data integration process that combines data from various sources into one consistent storage and is loaded into a data warehouse or other system.

Online Analytical Processing, also known as OLAP, is the ability to efficiently manipulate data from multiple perspectives or perspectives. The main operational structure in OLAP is based on a concept called the Cube. Cubes in OLAP are multidimensional data structures that allow rapid analysis.

The star schema consists of two kinds of tables, namely the fact table and the dimension table. The fact table contains quantitative and factual facts about a business such as the number of units sold, the number of health services and so on. The dimension table contains descriptive data regarding the business subject. Dimension tables are usually a source of attributes that are used to qualify, categorize or summarize facts in queries, reports or graphs. As the name implies, the Star Schema is a database schema where the ERD is shaped like a star.

**III. RESEARCH METHODS**

**A. Research Object, and Data Collection Method**

The object of this research is Data warehouse Management so that the leader or mayor can get fast and accurate information services. And for monitoring data, dashboards, statistics, and trends, every business is seen by the leadership to facilitate the evaluation and decision-making process in the Depok City Data warehouse.

In conducting research to obtain data and information, the methods used in the data collection process are carried out as follows: (a) Conduct direct observations to the OPD in charge of City data management, namely the Depok City Communication and Information Office to obtain the required data; (b) Conducting interviews with parties directly related to the problem to obtain a basic description and explanation; and (c) Looking for sources that can be used as references from data sources or literatures.

**B. Research Stages**

The stages of research/methodology used in making this Data warehouse Website Information System are as shown in Figure 1. In the analysis stage, a deeper analysis is carried out regarding the management of SIMPUS data and the information needed by the hospital management, based on this, it will be possible to identify the problems faced by the puskesmas and the Depok city government, especially related

to making reports on puskesmas services. Therefore, it is necessary to identify the desired report needs by making observations to find out the desired report format. After that, the design and modeling of the data warehouse will be made, which later is expected to be able to provide solutions to problems and be able to answer the information needs of the health department and city government. The previously collected data will be processed to be used as an analysis process for the information needs.

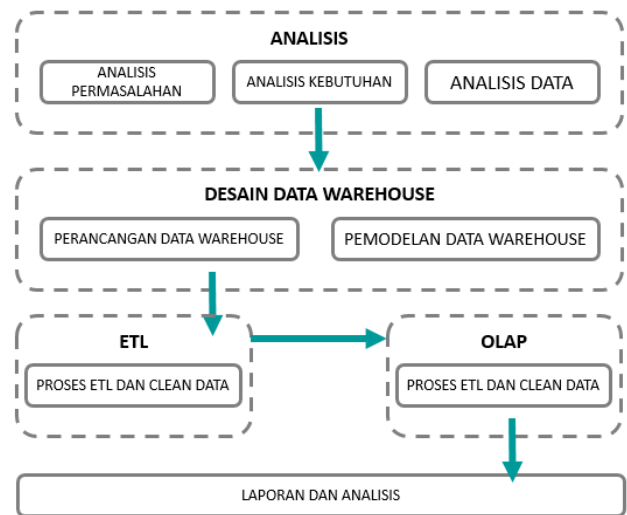


Fig. 1. Research Stage

The data warehouse design stage is the stage to determine the design of the data warehouse that will be implemented, which consists of: (a) data warehouse design using a fact table process which records sales transaction data: and (b) Data Warehouse modeling, from the results of relations between fact tables and the dining dimension table will be modeled in a data warehouse schema which will be a container or data area needed by the Depok city government. The model used to build a data warehouse is a star schema.

A data warehouse cannot exist without an ETL process because the ETL process is a set of processes that must be passed in the formation of a data warehouse and becomes the foundation of a data warehouse. The purpose of ETL is to collect, filter, process and combine relevant data from various sources to be stored in a data warehouse. Before using transactional data, it must first go through Extracting, Transforming, and Loading.

The OLAP process is the process of creating a SIMPUS database as a data source using MySQL 5.7. The data that will be processed with OLAP is data that has gone through the ETL process first, then will be transformed into a multidimensional database design at the data warehouse. The data is named table with 'F\_Kunjungan'. From the data warehouse, it is extracted into information that can be used by users to explore and analyze data using the Website Dashboard.

After all the OLAP processes have been completed and are able to meet the needs of the report, the next stage is reporting and analysis for reporting planning. The OLAP application is

built by connecting the Report Builder with the database to retrieve data in the database using MDX Query, so that it can then be displayed on the interface and can perform multidimensional analysis functions and integration into the city health dashboard information that informs the results of the data that has been entered into the data warehouse that has been processed in the fact table.

C. Development Method

The development of this Information System is carried out using the SDLC (System Development Life Cycle) development process methodology. SDLC is also a pattern taken to develop a software system, which consists of the following stages: planning, analysis, design, implementation, testing and maintenance.

The SDLC model used in this study is the Waterfall model. Waterfall Model or Classic Life Cycle is the most widely used model in Software Engineering (SE). According to Bassil (2012) it is called a waterfall because the stages that must be passed wait for the completion of the previous stage and run sequentially.

D. Data Sources

The health service data of the puskesmas used in the research data source was obtained from the Puskesmas Information System (SIMPUS) database used by the puskesmas. Where this service data is taken from January 2018 to March 2021. The data is used by the author in this study which will then be used in making the required reports.

IV. RESULT

A. Analysis

Based on the results of the analysis, it can be seen that the needs expected by the leaders of the Office and the Mayor are the availability of service monitoring information in the form of Dashboards and Reports from each puskesmas into a Data Warehouse application which will be processed in the Data Warehouse in the form of numbers and trend graphs to support Leadership Decision Making.

For this reason, this application is needed in the reporting system needed by the city government to plan and control the quality of city health services, from the data warehouse application, leaders can easily obtain data on health services both medical and non-medical. So that in designing this data warehouse, it must be mature in design so that in integrating historical data there are not many obstacles. The data drawn in the integration are the number of registration visits, patient data, patient diagnosis data, poly services, inpatient and outpatient services.

The data contained in the data warehouse is the result of selecting data taken from the Puskesmas Information System database, after connecting to the database, the next step can be cleaning the required data and adjusted to research needs, so that not all data can be presented.

B. Data Warehouse Design

In the data warehouse design process the author uses several stages, namely process selection, grain selection, dimension identification and adjustment, storing Fakta Table

pre-calculations, completing Dimension Tables, database duration, determining priorities and Query Models.

The modeling used and selected according to need, in this case the model used uses the Stars Schema (Star Schema). As the name implies Star Schema is a database schema where the ERD diagram is shaped like a star (star). The star schema is a fact table surrounded by dimension tables. Each star is technically a datamart and each data warehouse can have multiple stars or Data Marts. The purpose of the star schema is to modify the normalized OLTP table into a simple and normalized structure in the data warehouse. The relationship between the fact table and the five dimension tables can be seen in the Diagnostic Fact Table Relationship design in Figure 2, and the relationship between the fact table and the five dimension tables can be seen in the Visit Fact Table Relationship design in Figure 3.

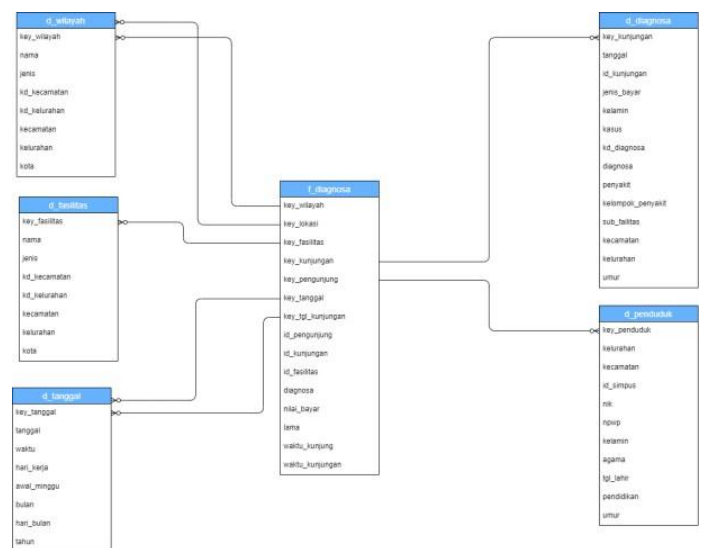


Fig. 2. Fakta Diagnose Table Relationship

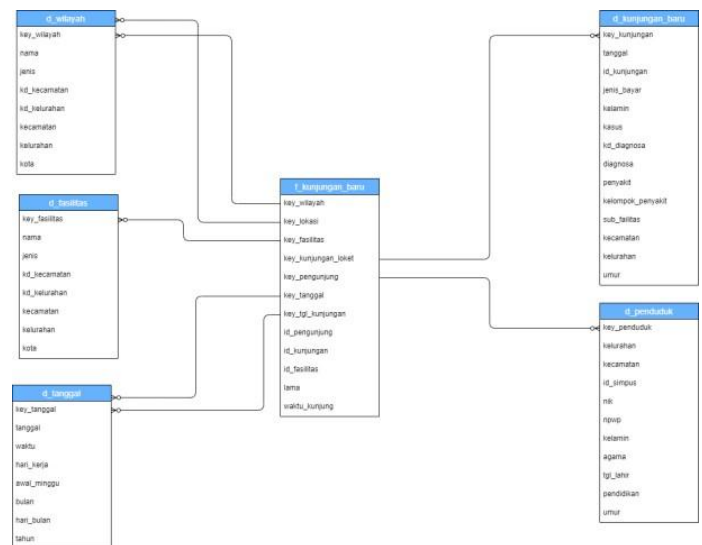


Fig. 3. Fakta Kunjungan Table Relationship

C. ETL Process (Extraction, Transformation, Loading)

The ETL process, is the process used to process data

before it is entered into a data warehouse, ETL is a very important process because it plays a very important role in the quality of the data in the data warehouse, where this process is carried out to standardize the data to be used in the data warehouse. The purpose of ETL is to collect, filter, manage and combine relevant data from various sources to be stored in the data warehouse. So it can be said that ETL is a critical step in creating a data warehouse. The results of this ETL process will produce data that meets data warehouse criteria such as historical, summarized, static, integrated and has a structure designed for the purposes of the analysis process. Usually the ETL process will be carried out periodically and automatically.

1. Extraction, At this stage, the extraction process will be carried out or data retrieval in accordance with the data needed in making this research. The Extraction process runs through the database and uses various criteria in selecting the data. And find the appropriate data. Data extraction was taken from the SIMPUS data source, previously filtering was carried out on patient visit registration data in January 2018 - March 2021. Then the data will be entered into the staging data table in the visit and diagnosis data warehouse database. For more details can be seen in Figure 4.

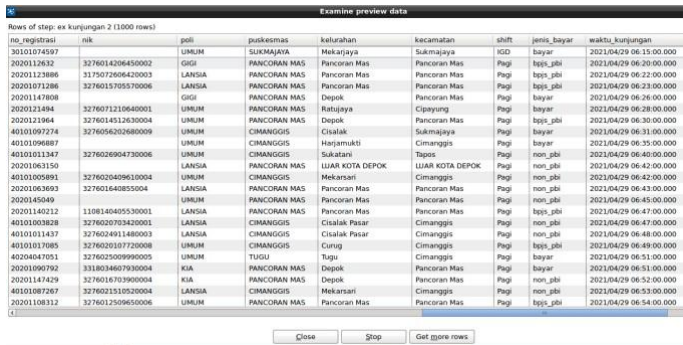


Fig. 4. Extract Process

2. Transformation, At this stage, the Transformation process will be carried out or the data will be transformed into a format that is the same as the data warehouse needs such as Kecamatan, Kelurahan and Period. The database used in the SIMPUS database is built on MYSQL, so that the types of data storage use the standard types provided by the DBMS such as int, varchar, date, number, datetime. The transformation process carried out is by making changes to several data types and adjusting the mapping value data that we want, in Figure 5 is the result of making the Transformation of Visit Facts and Diagnostic Facts.

3. Loading, The process carried out at this last stage serves to enter data into the final target, namely into the data warehouse. At this stage, the outline of the data is uniformized in the same data type format and the results of the transformation into a data warehouse are obtained to be forwarded to face-to-face applications and services that have been integrated. Where users can access the output of this loading stage in the form of Dashboards, Statistics and Trends. The presentation is done through reports or a

collection of data for analysis and decision making needs. The process of presenting the application using the PHP Phalcon application, can be seen in Figure 6.

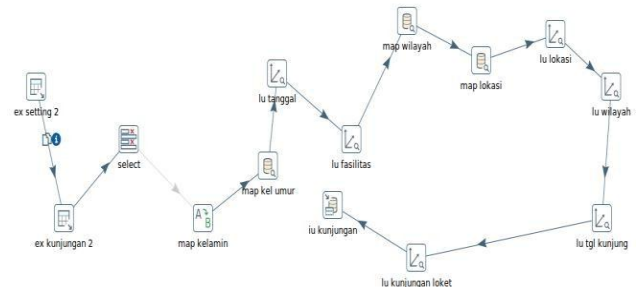


Fig. 5. Transformation Process



Fig. 6. Loading Process

D. Application of OLAP (Online Analytical Processing)

OLAP is a process used to make requests for data in complex forms and analyze large volumes of data. The capabilities possessed by OLAP allow users to be able to view data with different dimensions. In this study, the OLAP process is carried out by creating a Health and Diagnosis data source cube from the integrated Facts and Dimensions table where the data cube is the data source.

1. Schema Workbench, is an application that is used to make OLAP query structures based on cubes and dimensions, the first step in making this Schema Workbench is to first create a Cube by clicking the New Cube button. Create 2 cubes first with the name Aggregate Health and Diagnosis. Where we use the Health Aggregate for the service dimension of the Puskesmas and the Diagnosis Cube for the disease dimension of each patient.

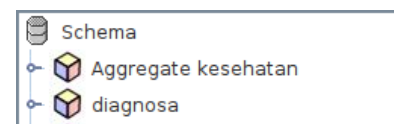


Fig. 7. Cube in Schema Workbench

The next step when you have created a cube is to create a Schema Dimension, the dimensions needed in making are the dimensions of time, area, dimensions, subdimensions and aggregates.

2. OLAP Query Creation, In making OLAP queries, you can use the Pivot4J application based on Open Source which

can be installed and downloaded, when it is installed, then the first page when it is opened like this, please select the catalog and cube that was created previously as shown in Figure 8.

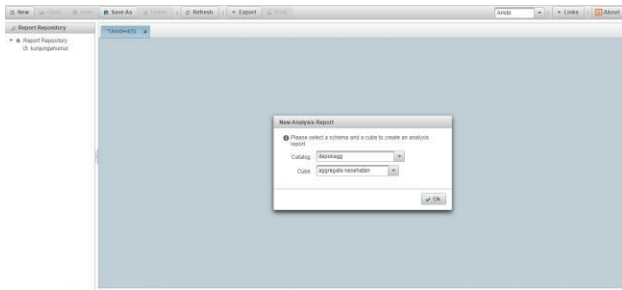


Fig. 8. Home Page Making OLAP Query using Pivot4J Application

E. Application Dashboard Exploration and Data warehouse Analysis

In this section, the author tries to provide information that can be retrieved from the Depok city data warehouse database that has been integrated before. Where the information generated by the Depok City Data Warehouse contains registration data for patient visits and patient diagnoses, the growth in the number of patients and diagnosis of diseases suffered by patients can be analyzed based on dimensions that have been extracted in the last 2 years for all health centers located in the area. depok city.

Dashboard exploration and data warehouse analysis, the author performs a simulation by running the design results by displaying some information based on the schema that has been designed. The following is a display of information that can be explored from the results of the Dashboard and Data warehouse analysis of the puskesmas.

1. Number of Trends in Puskesmas Visitors per Kecamatan

Jumlah Pengunjung Puskesmas per-Kecamatan Pada Tahun 2021

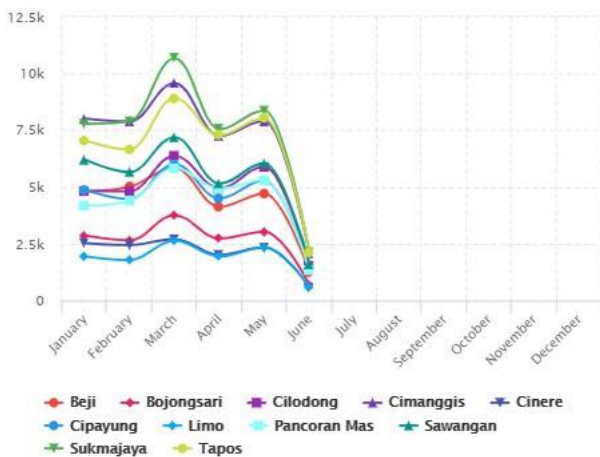


Fig. 9. Graph of the Number of Public Health Center Visitors per Kecamatan in 2021

2. Number of Public Health Center Visitors This

Year and Previous Years

Jumlah Pengunjung Puskesmas Depok Pada Tahun 2020 Dan Tahun 2021



Fig. 10. Graph of the Number of Public Health Center Visitors this Year and Previous Years

3. The Highest Number of Diseases in Each Year

Nama Penyakit	Jumlah Diagnosa
Hipertensi Primer (esensial)	103,038
Dispepsia	51,312
Penyakit Infeksi Saluran Pernafasan Atas Akut	41,823
Nasofaringitis Akuta (Common Cold)	41,343
Diabetes Mellitus Tidak Spesifik	29,736
Myalgia	28,449
Demam Yang Tidak Diketahui Sebabnya	20,487
Penyakit Virus Lainnya	19,029
Faringitis Akuta	18,231
Penyakit Pulpa Dan Jaringan Periapikal	16,845

Fig. 11. Number of Diseases and Number of Diagnosis

4. Number of Diseases Monitored

Penyakit Dimonitor Pada Tahun 2021

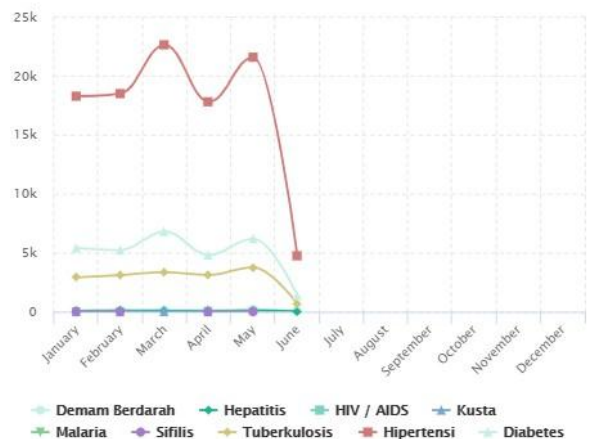


Fig. 12. Disease Graph Monitored in 2021

5. Disease Statistics by Gender



Fig. 13. Disease Statistics Chart by Gender

6. Disease Statistics by Payment Method



Fig. 14. Statistics Chart by Payment Method

7. Number of Patients Statistics by Type of Service

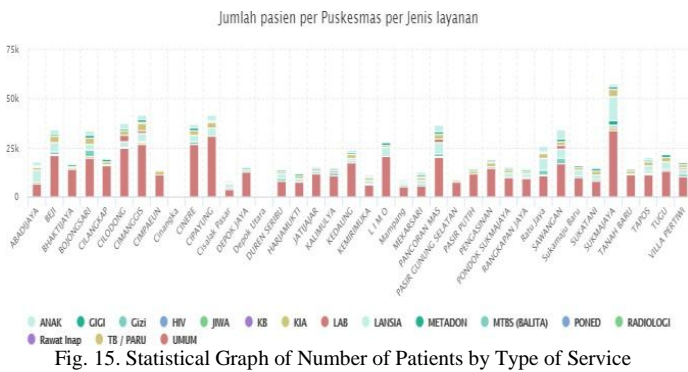


Fig. 15. Statistical Graph of Number of Patients by Type of Service

8. Disease Trends per month

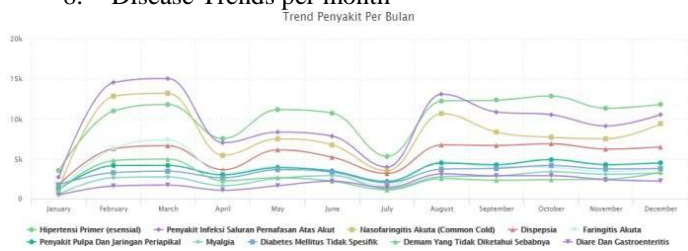


Fig. 16. Monthly Disease Trend Chart

9. Trend of Poly Service per Month

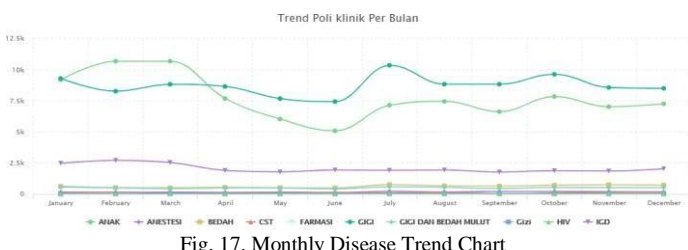


Fig. 17. Monthly Disease Trend Chart

10. Trend of Visiting Services per Age Group

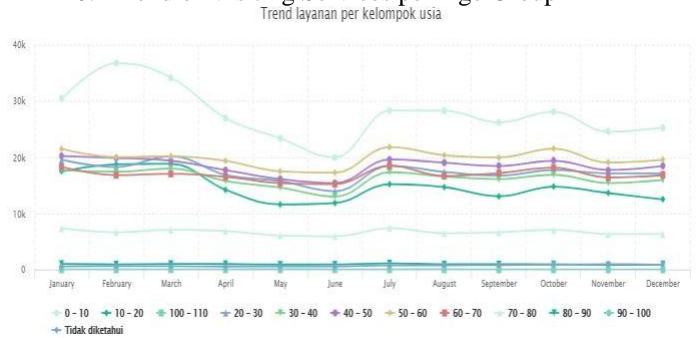


Fig. 18. Disease Statistics Chart by Gender

F. Test Performance Data

Performance testing is carried out to see changes and comparisons that have been made to improve data performance from before, previously in this application the performance was very slow in reading the data you want to appear in the form of statistical visualization and trends This is because the data that is read is detailed data that already consists of millions of rows of rows. Examples of performance data measured before using OLAP as shown in Figure 19.

Name	Status	Time
data	200	1.1 min
data	200	1.0 min
data	200	57.98 s
data	200	57.53 s
data	200	57.44 s
dataDiagnosa?_1625152841173	200	32.41 s
dataTables.min.js?_1625152841175	200	1.20 s
datawarehouse	200	296 ms
dataTahun?_1625152841171	200	275 ms
select2.full.min.js?_1625152841169	200	255 ms
widget	200	241 ms
dataKeurahan?kecamatan=&_1625152841174	200	237 ms
dataKecamatan?_1625152841172	200	231 ms
dashboard	200	183 ms
jquery.metisMenu.js?_1625152841167	200	175 ms
index?_1625152841168	200	160 ms
dataBulan?_1625152841170	200	136 ms
Layananperkecamatan	200	103 ms
statistikpenyakitmonitor	200	85 ms
layanankota2	200	43 ms

Fig. 19. Performance Data Measured Before Using OLAP

In the table image above, it can be seen that it takes about one minute to bring up one data. This time is quite a very long time in processing data and is not good in implementing the Data Warehouse Dashboard Application. After repairing with a new method using OLAP the results obtained are under one second, as shown in Figure 20.

Name	Status	Time
dashboard	200	187 ms
data	200	2.35 s
data	200	749 ms
data	200	910 ms
data	200	1.20 s
data	200	887 ms
dataBulan?_1625154253573	200	78 ms
dataDiagnosa?_1625154253576	200	994 ms
dataKecamatan?_1625154253575	200	181 ms
dataKeurahan?kecamatan=&_1625154253577	200	153 ms
dataTables.min.js?_1625154253578	200	2.95 s
dataTahun?_1625154253574	200	210 ms
datawarehouse	200	38 ms
index?_1625154253571	200	206 ms
jquery.metisMenu.js?_1625154253570	200	20 ms
layanankota2	200	442 ms
layanaperkecamatan	200	438 ms
penyakitmonitor2	200	438 ms
select2.full.min.js?_1625154253572	200	48 ms
widget	200	151 ms

Fig. 20. Performance Data Measured After Using OLAP

V. CONCLUSION

A. Conclusion

The measurement scenario that is being carried out at this time uses the usual time calculation and uses the tools that have been provided by each browser, I currently use the Google Chrome Browser, It looks like the picture above the comparison of the resulting time is quite far compared to without using OLAP.

Scenario measures at this time using regular time calculations and tool tools available by any browser, currently I use Google chrome browsers, look like pictures above the time limit generated by not using olap, andin other instances assisted by the black box method in taking notes testing the time measurement from before and after its completion.

No	Pengujian	Hasil		Status
		Sebelum	Sesudah	
<b>A</b>	<b>Dashboard</b>			
A01	Widget Data	01:30	00:01	PASS
A02	Jumlah pengunjung puskesmas per kecamatan	02:20	00:01	PASS
A03	Jumlah pengunjung puskesmas tahun ini dan tahun lalu	01:50	00:03	PASS
A04	Penyakit Terbanyak	01:31	00:01	PASS
A05	Penyakit di Monitor	02:31	00:02	PASS
<b>B</b>	<b>Statistik</b>			
B01	Penyakit berdasarkan kelompok usia	01:29	00:01	PASS
B02	Penyakit berdasarkan jenis kelamin	01:00	00:02	PASS
B03	penyakit berdasarkan metode pembayaran	01:05	00:01	PASS
<b>C</b>	<b>Trend</b>			
C01	Layanan Pasien berdasarkan kelompok usia	01:15	00:02	PASS
C02	Layanan Pasien berdasarkan jenis kelamin	01:02	00:01	PASS
C03	Layanan Pasien berdasarkan Trend Penyakit	02:15	00:03	PASS

Fig. 21. Performance Testing Results Using Black Box Testing on Query Data

In the Puskesmas Service Data Warehouse design, this research uses Stars Schema modeling with four facts, namely the Diagnosis Facts table, Visit Fact table, Diagnosis Agg Fact table, tables, Visit Agg Facts and ten dimension tables namely Population Dimension table, Area dimension table, table Time Dimension, Health Facility Dimension table, Diagnostic

Dimension table, Visit Dimension table, Gender Dimension table, Content Dimension table, Diagnostic Aggregate Dimension table, Health Aggregate Dimension table, all of these tables are processed into Stars Schema. These are formed through the OLAP process using visit data. patients and diagnoses at the puskesmas located in the Depok City area.

From the OLAP process, a data warehouse design has been created to analyze data from various dimensions which are then made to display information in graphical form or dashboards so that information is easy to read and understand by various parties. From the results of this writing, the authors draw the following conclusions:

1. Increasing data warehouse applications by entering data from the SIMUS application, especially in terms of the types of information, functions and graphical displays; optimally designed to analyze data into statistical and graphical information.
2. Increased diversity of wider data by taking visit data from 38 Puskesmas in Depok City, so that the use of data on Regional Apparatus is more useful;
3. Data retrieval has used the ETL method system (Extract, Transform, and Load) to read different data sources and stream the data to the data warehouse database
4. Increased performance of the data generated and better than before, namely data that was run before using the current method, the time generated in displaying data was up to 1 minute far from the comparison when using the new method, the results obtained were less than in displaying data only 1 second
5. The use of the puskesmas data warehouse is quite useful for managing very large amounts of data, so that the information presented will be very interesting and effective in integration
6. Data Warehouse can be used to analyze patient visit data. So that its use can be used to analyze the increase in patients from each dimension that has been made. So it is hoped that the needs of leaders in making decisions and policies will be very fast and fulfilled.

B. Recommendation

In order to develop a data warehouse to be even better than it is now in the future, based on this research, several suggestions can be submitted for use in further research. Researchers will convey some suggestions as follows:

1. Researchers provide suggestions for further development to the stage of implementing data mining so that the results of data analysis can be carried out in more depth and arranged based on existing approaches
2. Researchers provide suggestions in the future so that this data warehouse method can be developed for forecasting or data prediction for much faster decision-making steps
3. Researchers suggest that in the future the data warehouse can be wider, not only recording patient visits, but can measure indicators of the comparison of the number of patients who come with the number of health workers in Depok city
4. Researchers also provide suggestions for the development



of a more attractive and more dynamic interface in the future. And it can be used more broadly in order to improve the quality of public health services in the Depok City area

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